

Environmental Risk Communication and Engagement



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Communication Issues

Pollutants and contaminants, multiple or single

- **chemical nomenclature and synonyms**
- **measurement units (dissolved versus total)**
- **oxidation state**
- **enforceable standards versus recommended guidelines**
- **Background contaminants**

Affected media

Exposure pathways and durations

Risk variables (cancer, non-cancer, acute, chronic)

Limited English proficiency

Contaminants, Pollutants, Substances

Are “contaminants” and “pollutants” synonymous?

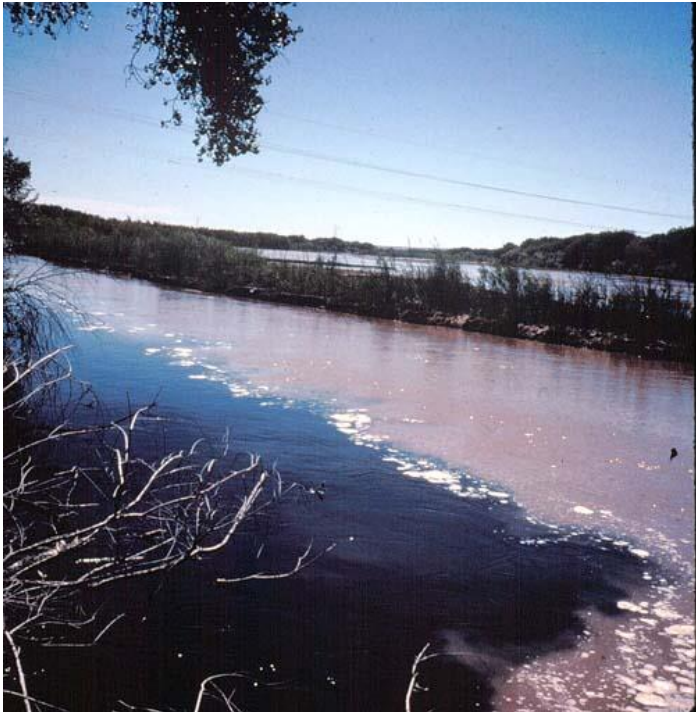
It depends on which statutory jurisdiction you are working in.

Contaminants, Pollutants, Substances

Federal Water **Pollution** Control Act (1948)

- **First major U.S. law to address water pollution.**
- **Authorized the Surgeon General of the Public Health Service, in cooperation with other Federal, state and local entities, to prepare comprehensive programs for eliminating or reducing the **pollution** of interstate waters and tributaries and improving the sanitary condition of surface and underground waters.**

Contaminants, Pollutants, Substances



NM Water Quality Act (1967)

- “**water contaminant**’ means any substance that could alter, if discharged or spilled, the physical, chemical, biological or radiological qualities of water”
- “**water pollution**’ means introducing or permitting the introduction into water, either directly or indirectly, of one or more water contaminants in such quantity and of such duration as may with reasonable probability injure human health, animal or plant life or property, or to unreasonably interfere with the public welfare or the use of property”

Contaminants, Pollutants, Substances

Clean Water Act (1972, sweeping amendments to the Water **Pollution** Control Act)

- The term "**pollutant**" means dredged spoil, solid waste, incinerator residue, sewage, garbage, sewage sludge, munitions, chemical wastes, biological materials, radioactive materials, heat, wrecked or discarded equipment, rock, sand, cellar dirt and industrial, municipal, and agricultural waste discharged into water.
- The term "toxic **pollutant**" means those **pollutants**, or combinations of **pollutants**, including disease-causing agents, which after discharge and upon exposure, ingestion, inhalation or assimilation into any organism, either directly from the environment or indirectly by ingestion through food chains, will, on the basis of information available to the Administrator, cause death, disease, behavioral abnormalities, cancer, genetic mutations, physiological malfunctions (including malfunctions in reproduction) or physical deformations, in such organisms or their offspring.
- The term "**pollution**" means the man-made or man-induced alteration of the chemical, physical, biological, and radiological integrity of water.
- National **Pollutant** Discharge Elimination System (NPDES)

Contaminants, Pollutants, Substances

Federal Safe Drinking Water Act (1974)

- “The term “**contaminant**” means any physical, chemical, biological, or radiological substance or matter in water.”
- Maximum **Contaminant** Level (MCL), **Contaminant** Candidate List, Unregulated **Contaminant** Monitoring Rule (UCMR)



Contaminants, Pollutants, Substances

Federal Toxic Substances Control Act (TSCA, 1976)

- **Chemical substance** means any organic or inorganic substance of a particular molecular identity, including any combination of such substances occurring in whole or in part as a result of a chemical reaction or occurring in nature, and any chemical element or uncombined radical, except that “chemical substance” does not include:
 - (1) Any **mixture**.
 - (2) Any pesticide when manufactured, processed, or distributed in commerce for use as a pesticide.
 - (3) Tobacco or any tobacco product.
 - (4) Any source material, special nuclear material, or byproduct material.
 - (5) Any pistol, firearm, revolver, shells, or cartridges.
 - (6) Any food, food additive, drug, cosmetic, or device, when manufactured, processed, or distributed in commerce for use as a food, food additive, drug, cosmetic, or device.
- **Mixture** means any combination of two or more chemical substances if the combination does not occur in nature and is not, in whole or in part, the result of a chemical reaction; except “mixture” does include (1) any combination which occurs, in whole or in part, as a result of a chemical reaction if the combination could have been manufactured for commercial purposes without a chemical reaction at the time the chemical substances comprising the combination were combined, and if all of the chemical substances comprising the combination are not new chemical substances ...

Contaminants, Pollutants, Substances

Federal Resource Conservation and Recovery Act (RCRA, 1976)

- RCRA was an amendment to the **Solid Waste Disposal Act of 1965**.
- The term “**solid waste**” means any garbage, refuse, sludge from a waste treatment plant, water supply treatment plant, or air pollution control facility and other discarded material, **including solid, liquid, semisolid, or contained gaseous material** resulting from industrial, commercial, mining, and agricultural operations, and from community activities...

Contaminants, Pollutants, Substances

Federal Comprehensive Environmental Response Compensation and Liability Act (CERCLA, “Superfund”, 1980)

The term “**pollutant or contaminant**” shall include, but not be limited to, any element, substance, compound, or **mixture**, including disease-causing agents, which after release into the environment and upon exposure, ingestion, inhalation, or assimilation into any organism, either directly from the environment or indirectly by ingestion through food chains, will or may reasonably be anticipated to cause death, disease, behavioral abnormalities, cancer, genetic mutation, physiological malfunctions (including malfunctions in reproduction) or physical deformations, in such organisms or their offspring; except that the term “**pollutant or contaminant**” **shall not include petroleum ...**

Chemical Nomenclature Challenges

- **Chemical Elements** - Arsenic (As), Chromium (Cr), Lead (Pb, Latin, plumbum), Mercury (Hg, Latinized Greek, hydrargyrum meaning “silver water”)
- **Atomic number** - number of protons in the nucleus of an atom:
$$\text{Lead (Pb) atomic number } 82 = {}_{82}\text{Pb}$$
- **Isotopes** - same element, same number of protons, different number of neutrons, different atomic mass:
$${}^{208}\text{Pb} = \text{lead-208 (stable)} / {}^{210}\text{Pb} = \text{lead-210 (radioactive)}$$
- **Oxidation state** - number of electrons that an atom can gain or lose in chemical bonding:
$$\text{Cr III} = \text{trivalent chromium} / \text{Cr VI} = \text{hexavalent chromium}$$
- **Chemical compounds** - 1,2-dibromoethane = ethylene dibromide (EDB)
- **Nitrogen (N)** - nitrate (NO_3), nitrate-N, nitrite (NO_2), nitrite-N, ammonia (NH_3), ionized ammonia (NH_4^+) = ammonium, total Kjeldahl nitrogen (TKN)

Standards and Guidelines for Lead

Water (mg/L)	
Drinking Water¹	
• Goal	Zero
• Action level	0.015 (total)
Ground Water²	0.015 (dissolved)
Surface Water³	
• Domestic water supply	0.015 (dissolved)
• Aquatic life, acute	0.14 (dissolved)
• Aquatic life, chronic	0.005 (dissolved)
• Irrigation	5 (dissolved)
• Livestock	0.1 (dissolved)

Standards and Guidelines for Lead

Sediment/Soil (mg/kg)	
Migration to Groundwater ⁴	270
Human Health, Residential ⁴	400
Human Health, Industrial ⁴	800
Flora ⁵	120
Invertebrates ⁵	1,700
Birds ⁵	11
Mammals ⁵	56
Hazardous Waste Characteristics (TCLP rule of 20) ⁶	100

Standards and Guidelines for Lead

Air⁷ (ug/m³)	
Ambient Air	0.15
Food⁸ (mg/kg)	
Fruiting Vegetables	0.05
Cattle, Pig and Sheep Meat	0.1
Fish Meat	0.3
Human Blood	
All Blood Levels ⁹	Notification required
Children's Blood ¹⁰ (ug/dL)	5

References for Standards and Guidelines

- ¹ U.S. Environmental Protection Agency (EPA) Drinking Water Regulations. <https://www.epa.gov/dwreginfo/drinking-water-regulations>
- ² N.M. Water Quality Control Commission (WQCC), Groundwater Standards (Section 20.6.2.3103.A.1). <https://www.srca.nm.gov/parts/title20/20.006.0002.html>
- ³ N.M. WQCC, Standards for Interstate and Intrastate Surface Waters (Section 20.6.4.900.J). <https://www.srca.nm.gov/parts/title20/20.006.0004.html>
- ⁴ N.M. Environment Department, Risk Assessment Guidance for Site Investigations and Remediation. <https://www.env.nm.gov/wp-content/uploads/sites/12/2016/11/Final-NMED-SSG-VOL-I -Rev.2-6 19 19.pdf>
- ⁵ U.S. EPA, Ecological Screening Levels for Lead. https://www.epa.gov/sites/production/files/2015-09/documents/eco-ssl_lead.pdf
- ⁶ U.S. EPA, Method 1311, Toxicity Characteristic Leaching Procedure (TCLP) and 20X guidance. <https://www.epa.gov/sites/production/files/2015-12/documents/1311.pdf> (Section 1.2) and https://archive.epa.gov/epawaste/hazard/web/html/faq_tclp.html (total constituent analysis instead of TCLP analysis)
- ⁷ U.S. EPA, National Ambient Air Quality Standards. <https://www.epa.gov/criteria-air-pollutants/naaqs-table>
- ⁸ Codex Alimentarius Commission, International Food Standards, CXS 193-1995, General Standard for Contaminants and Toxins in Food and Feed. <http://www.fao.org/fao-who-codexalimentarius/thematic-areas/contaminants/en/#c452833>
- ⁹ N.M. Department of Health, Notifiable Diseases or Conditions in New Mexico, (Section 7.4.3.13.D.7). <https://www.srca.nm.gov/wp-content/uploads/attachments/07.004.0003.pdf>
- ¹⁰ U.S. Centers for Disease Control and Prevention, Blood Lead Reference Value. <https://www.cdc.gov/nceh/lead/prevention/blood-lead-levels.htm>

Public Engagement Opportunities

Listening Sessions

Field Trips

Teach-Ins

Citizen Advisory Group

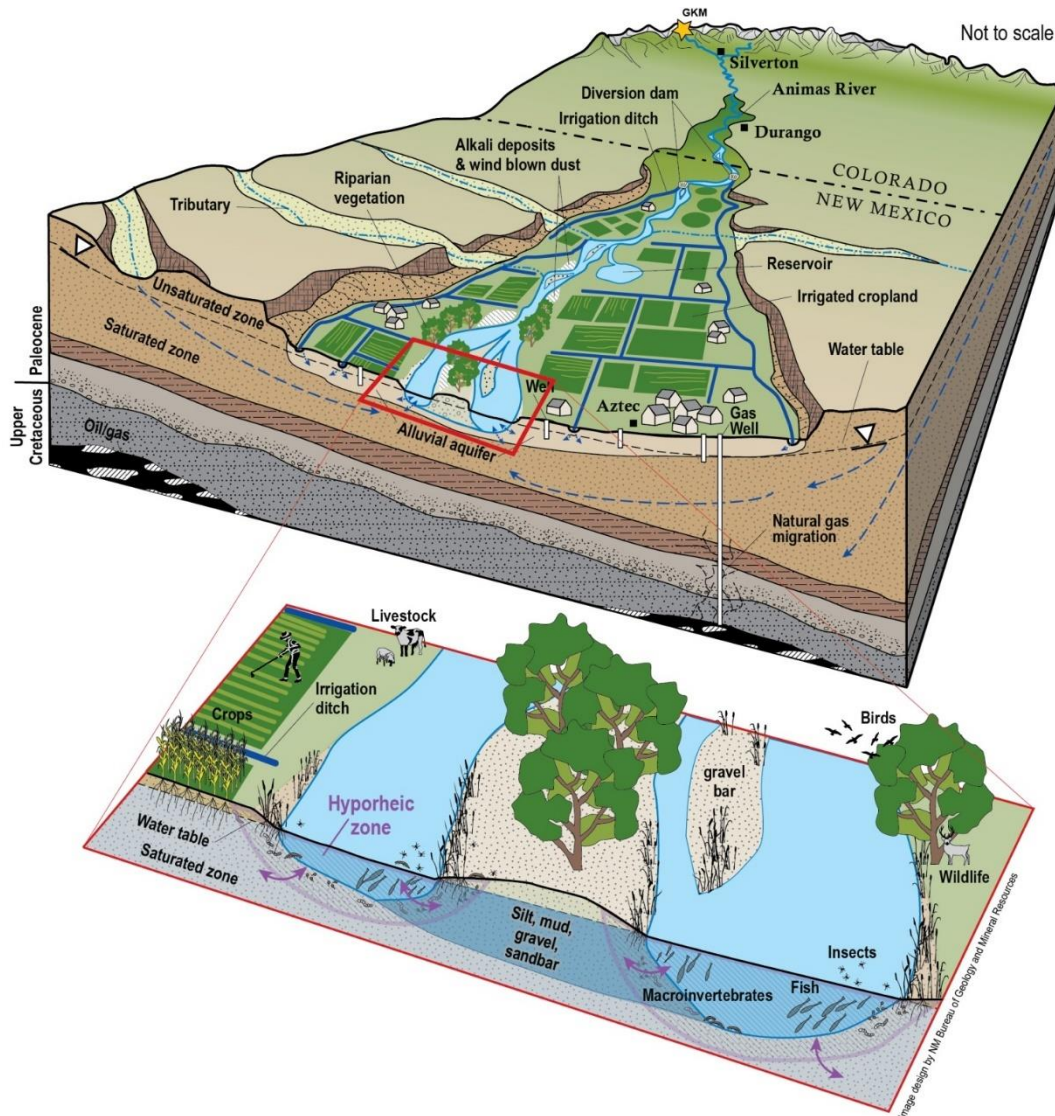
Citizen Science

Milestone meetings:

- **Progress Reports**
- **Investigation Proposal**
- **Investigation Report with conceptual site model**
- **Risk Assessment (human and ecological; comparative)**
- **Remedy Selection**
- **Biomonitoring**



Have a Good Conceptual Model (Animas River Watershed System¹)



Watershed Contaminants

- Metals
- Nutrients
- E. Coli
- PFAS

Human Exposure Pathways

- Drinking surface or groundwater
- Swimming/boating
- Sediment exposure
- Ingestion of crops, livestock, fish, wildlife
- Airborne dust

¹ N.M. Bureau of Geology <https://geoinfo.nmt.edu/geoscience/research/home.cfm?id=26>

High Stress Situations Where Stakeholders May be Angry and Fearful

- Incidents where people are or may be evacuated from their homes, or where homes are damaged or destroyed:
 - Spills and HazMat incidents
 - Wildfires
 - Floods
 - Extreme Temperatures
- Water outages
- Waterborne or environmental disease outbreaks
- Boil-water orders

Counselling and suicide prevention professionals may be needed.

Civil Rights

Federal Civil Rights Act (1964)

- **Discrimination is prohibited.**



New Mexico Civil Rights Act (2021)

- **Provides for claims against public bodies for violations of N.M. Constitution, Bill of Rights.**
- **Prohibits defense of qualified immunity.**

Environmental Justice

Executive Order 12898 - Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations (1994)

Directs federal agencies to:

- **Identify and address the disproportionately high and adverse human health or environmental effects of their actions on minority and low-income populations, to the greatest extent practicable and permitted by law;**
- **Develop a strategy for implementing environmental justice; and**
- **Promote nondiscrimination in federal programs that affect human health and the environment, as well as provide minority and low-income communities access to public information and public participation.**

Citizen Science

Federal Crowdsourcing and Citizen Science Act (2010)

"The term 'citizen science' means a form of open collaboration in which individuals or organizations participate voluntarily in the scientific process in various ways, including-

- (A) enabling the formulation of research questions;**
- (B) creating and refining project design;**
- (C) conducting scientific experiments;**
- (D) collecting and analyzing data;**
- (E) interpreting the results of data;**
- (F) developing technologies and applications;**
- (G) making discoveries; and**
- (H) solving problems."**

